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(54) MEANS FOR IMPROVING THE FLOW OF GRANULAR OR SLUGGISHLY FLOWING MATERIAL IN A CONTAINER

(71) I, BJARNE SEM, a Norwegian subject of Niels Juelsgt. 13, Oslo 2, Norway,

do hereby declare the invention, for which I pray that a Patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following Statement: —

The invention relates to means for improving the transport of granular material or sluggishly flowing material, for example, concrete, through a container.

Norwegian Patent Specification No. 119,074 describes a container for the transport of granular material or sluggishly flowing material by means of compressed air. The container comprises a funnel-shaped bottom part terminating in a discharge opening and at least one nozzle arranged for introduction of compressed air on the inner peripheral surface of the container, the axis of said nozzle being inclined obliquely downward with respect to the axis of the container. In order to achieve efficient transport, the nozzle is provided with a plate shaped element, located with its plane at right angles to the axis of the nozzle and provided with a plurality of through-channels arranged in a circle and obliquely disposed with respect to said plane in the same direction along the circle. A turbulent motion is thus produced in the compressed air which, in turn, results in an advantageous transport of the material.

It has been found, however, that this formation of turbulence is not always adequate, and this applies particularly with "extreme" mixtures, for example rich or lean, dry concrete mixes. Such masses either flow too sluggishly or adhere to the walls of the container.

The present invention aims to improve the effect produced by the compressed air nozzles, so as to improve the transport of the material and improve the turbulence of the material with less adherence to the walls of the container.

According to the invention, means for improving the transport of granular material or sluggishly flowing material through a container, comprises at least one nozzle adapted to introduce compressed air into the container, a cylindrical housing joined to the nozzle for supplying compressed air to the nozzle, a plate-shaped element provided with turbulence-producing channels arranged in the housing at or adjacent to the inlet end of the nozzle, a rotor arranged in the housing between said element and an end wall of the housing, and an inlet for supplying compressed air to the housing in the region of said rotor, the compressed air supply inlet being inclined to a radial plane of said housing.

The means according to the invention has the advantage that, in addition to the production of turbulence in the compressed air, vibrations and/or pulses are produced both for the introduced air and for the entire housing and thus the nozzle and its connection to the actual container. With concrete, therefore, this means that the concrete slurry will be drawn more rapidly out toward the container wall and improve the sliding effect of the concrete. The irregularities in air supply and vibrations accentuate the turbulence and cause a reduction of friction on the sides of the container.

The pulsing or vibration can be accentuated in different embodiments of the means according to the invention. Thus, the rotor may have the form of at least one rod-shaped element having a closure plate at least at one end thereof. Suitably the closure plate is then disposed obliquely with respect to the cylindrical surface of the housing. Such a rotor cuts off the supply of air substantially completely each time it passes the air inlet and thus produces a pulsation which can be re-

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gulated by the number of rod elements with closure plates, and by means of the air pressure. One closure lement is generally adequate. Th rotor is rotated by the compressed air introduced and should therefore have a somewhat oblique disposition with respect to the cylindrical surface, so that the air introduced tangentially through the inlet exerts a displacing force on the plate. The fact that a small opening remains and complete closure is not achieved, is insignificant.

If pulsation of the air is preferred, it is expedient to make the rotor from light material and with its centre of gravity located on its axis of rotation. The advantage of a light construction with uniform rotation is achieved thereby.

If a mass which readily adheres to the walls is to be transported in the container, however, it may be desirable also to provide mechanical vibration. It is then expedient to make the rotor from heavy material and with its centre of gravity eccentric with respect to its axis of rotation. It is then possible to produce both mechanical vibration of the entire container and pulsation, which is achieved by means of the closure plate, or the closure plate may be omitted so that only an eccentric rotor is provided which imparts vibration or agitation to the apparatus and merely a weak pulsation of the air flow.

The invention will now be described by way of example, with reference to the accompanying drawing, in which

Figure 1 is a side view of the lower part of a container for the compressed-air transport of granular material or material which flows sluggishly, for example concrete, provided with means in accordance with the invention,

Figure 2 is a sectional view, on an enlarged scale, of part of the container of Figure 1, and

Figure 3A-C are sectional views, on the line III-III of Figure 2 showing three different embodiments of the rotor in the container part of Figure 2.

Figure 1 shows the lower funnel-shaped part 1 of a container connected at its lower end to a discharge pipe 2. Compressed-air is introduced into the container from a compressor, not shown, through a number of nozzles 3 arranged in the wall of the container, each nozzle being secured, for example by a screw connection, to a cylindrical housing 4. The compressed air is introduced into the housing 4 from the compressor through a pipe 5 which enters the cylindrical housing tangentially, as shown in Figures 3A-3C.

In the housing 4, a turbulence-producing, plate-shaped element 6 is mounted adjacent the nozzle 3. The construction of this element is described in detail in Norwegian Patent Specification No. 119,074 and is only shown sch matically in Figure 2. A shaft 7 is arranged between the plate-shaped element 6 and the end wall 8 of the housing 4, a rotor 9 being secured to this shaft opposite the air inlet pipe 5.

As will be clear from the Figures 3A-3C, the air inlet pipe 5 is obliquely disposed, tangentially in the example shown, with respect to the cylindrical casing of the housing 4. In the embodiments shown in Figures 3A-3C the rotor 9 is formed as a rod-shaped element. A plurality of such rod-shaped elements may, however, be used, or some other shape of rotor.

Figures 3A-C illustrate three different constructions of the rotor 9. In Figure 3A, the rotor 9 consists of a rod-shaped element which rotates about the shaft 7 and is provided at one end with a closure plate 10, the rod-shaped element being provided at its other end with a counter-balance 11 or the like, so that the centre of gravity of the rotor lies on its axis of rotation. The closure plate 10 is of a shape such that, dimensionally, it masks the aperture formed where the pipe 5 joins the casing 4. In order to achieve the best possible displacement force from the compressed air introduced through the pipe 5, since the compressed air constitutes the driving force for the rotor, the plate 10 is somewhat obliquely disposed with respect to the cylindrical surface of the housing as shown in Figure 3A. Complete closure of the pipe 5 is admittedly not achieved with this embodiment, but the closure will be sufficient to achieve the desired effect. The inlets for the turbulence channels in the element 6 are also indicated in Figure 3A.

If mechanical vibration, of the entire unit, including the container 1, is desired the construction shown in Figure 3B may be used. In this Figure the rotor 9 is of the same construction as the rotor of Figure 3A, except that the counter-balance 11 is omitted so that the centre of gravity of the rotor does not lie on its axis of rotation. An eccentric effect is thus achieved which, in addition, imparts mechanical agitation.

If such mechanical agitation is preferred, the rotor construction shown in Figure 3C can be used. In this Figure, the rotor 9 does not have a closure plate and there is an uneven weight distribution of the arms of the rod-shaped element provided by a weight at 12. A powerful eccentric effect and reduced air pulsation is thus obtained.

WHAT I CLAIM IS:—

1. Means for improving the transport of granular material or sluggishly flowing material through a container, comprising at

least one nozzle adapted to introduce compressed air into the container, a cylindrical housing joined to the nozzle for supplying compressed air to the nozzle, a plate-shaped element, provided with turbulence-producing channels, arranged in the housing at or adjacent to the inlet end of the nozzle, a rotor arranged in the housing between said element and an end wall of the housing, and an inlet for supplying compressed air to the housing in the region of said rotor, the compressed air supply inlet being inclined to a radial plane of said housing.

2. Means according to claim 1, in which the rotor is arranged to produce a pulsating effect in the air supply to the nozzle.

3. Means according to claim 2, in which the rotor comprises at least one rod-shaped element having a closure plate for the inlet pipe at least at one end thereof.

4. Means according to claim 3, in which the closure plate is obliquely disposed with respect to the cylindrical surface of the housing.

5. Means according to any of claims 1 to 4, in which the rotor is made of light material and has its centre of gravity located on its axis of rotation.

6. Means according to any of claims 1 to 4, in which the rotor is arranged to vibrate the housing.

7. Means according to claim 6, in which the rotor is made of heavy material and has its centre of gravity located eccentrically with respect to its axis of rotation.

8. Means for improving the transport of granular material or sluggishly flowing material, constructed and arranged substantially as herein described with reference to, and as illustrated in, Figure 2 and any of Figures 3A-3C of the accompanying drawing.

9. A container for the transport of granular material or sluggishly flowing material provided with the means claimed in any of the preceding claims.

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1 SHEET This drawing is a reproduction of the Original on a reduced scale

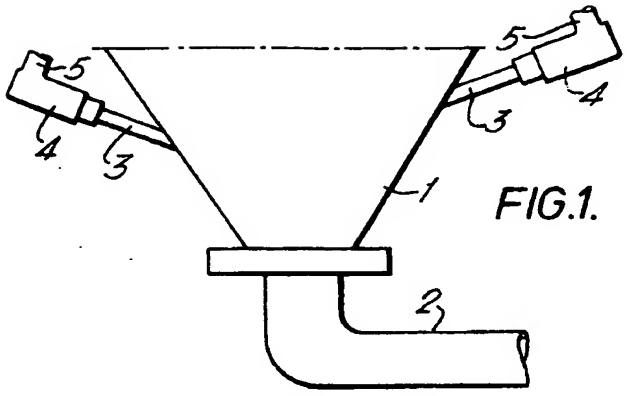

FIG.1.

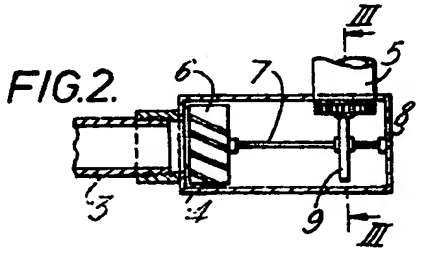

FIG.2.

FIG.3A.

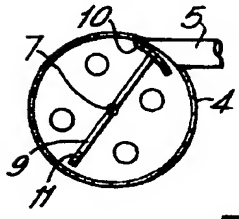

FIG.3B.

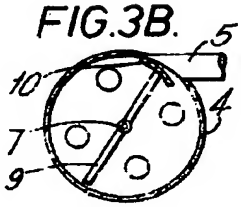

FIG.3C.